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Wood Use

U.S. Competitiveness and Technology

Summary

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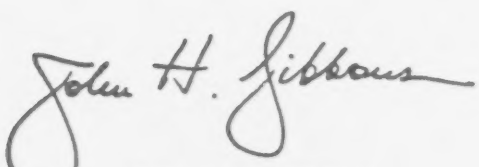
Foreword

The Office of Technology Assessment has conducted an assessment of the role of technology in the U.S. forest products industry. It was undertaken at the request of Senator Mark Hatfield, Chairman of the Senate Committee on Appropriations, and Senator Thad Cochran, Chairman of the Subcommittee on Agriculture, Rural Development, and Related Agencies. Representative James Weaver, Chairman of the Subcommittee on Forests, Family Farms, and Energy, joined in support of the assessment in the House of Representatives. This summary presents the major findings of the assessment of technology in the U.S. forest products industry.

The full assessment surveys the contribution of the forest products industry to the U.S. economy, the ability of the industry and the U.S. forest resource to satisfy expected domestic demands for wood, the competitiveness of U.S. forest products on world markets, and the role of technology in stretching the U.S. forest resource and providing products that satisfy domestic needs as well as international markets. It discusses the relationship of various levels of government and the forest products industry in providing for future wood products needs. Finally, it presents policy options designed to enhance the advantages of U.S. producers in international markets, to provide research and development in forest management, environmental effects of forestry, and wood materials science, and to improve the productivity of U.S. forests.



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NOTE: OTA is grateful for the assistance of its project advisory panel, chaired by Larry Tombaugh, and the members of its Wood Science and Technology Working Group and for the advice of numerous reviewers in agencies of the U.S. Government, academia, and industry. However, OTA assumes full responsibility for its report, which does not necessarily represent the views of individual members of its advisory panel or working group.

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Wood Use: U.S. Competitiveness and Technology

Summary

The United States could greatly expand its role in world forest products trade over the next decade and could become a net exporter of solid wood and paper products before 1990. For the past 30 years, the United States typically has imported more forest products than it has exported. Because exports have grown faster than imports, the trade deficit has narrowed. This trend is likely to continue.

Global demand for a wide range of forest products is growing rapidly, but the best trade opportunities for U.S. producers appear to be in the paper markets of other industrialized nations, particularly Western Europe and Japan. In contrast to many basic U.S. industries, the forest products industry has distinct advantages over its foreign competitors. The U.S. forest products industry is the most productive and among the most efficient in the world, and it benefits from a vast and highly productive domestic forest resource.

The United States and Canada are expected to remain the world's largest mutual trading partners in wood products, continuing to exchange those products for which one country has a competitive advantage over the other. Continued imports of Canadian low-value lumber and newsprint may result in greater opportunities for U.S. producers to export products such as linerboard and high-value lumber where the U.S. competitive edge is greatest.

To capitalize on international trade opportunities, the forest products industry and the Federal Government probably will have to make concerted efforts to promote exports. Although responsibility for developing foreign markets rests primarily with the private sector, government action will be needed to overcome trade barriers that currently inhibit the competitiveness of U.S. wood products in foreign markets.

Past Government and private sector concerns regarding a possible domestic timber shortfall no longer seem justified. Future timber needs, especially for housing but also for other products, probably have been overestimated. The effects of intensive timber management and the ability of wood utilization technology to stretch the wood resource have probably been underestimated.

If current trends toward more intensive forest management continue, domestic needs for wood probably can be met without dramatic price increases. However, substantial investments in forest management would be required to increase wood production beyond the levels expected to result from current trends. U.S. timber harvests can be more than doubled over the long term through increased application of intensive forest management technologies such as applied genetics, fertilization, and improved harvesting systems. To achieve the full economic potential of U.S. forestlands, an estimated investment of $10 billion to $15 billion would be needed over the next 30 to 50 years.

Existing and emerging technologies enable a broad range of wood products to be manufactured from currently underutilized hardwood species and from waste wood material. For example, high-strength papers now are made from hardwoods, once considered impossible. Many manufacturing technologies are available which have not been commercialized, but future economic conditions probably will warrant commercialization of many of these, and research and development (R&D) will continue to play an important role in the introduction of new products.

Several factors could affect future timber availability; however, none are expected to seriously limit future wood supply, unless demand increases dramatically without adoption of intensive forest management and wood utilization technologies. These factors include a shrinking forestland base, a large portion of U.S. forests in private nonindustrial ownership that may not be managed for commercial timber production, and the recent trend toward significantly increased use of wood fuel.

Commercial timber production is only one of many uses for U.S. forestland. Other uses include wildlife habitat, rangeland, watershed protection, wilderness, and recreation. Achieving a balance among many forest uses, especially on Federal lands, is a fundamental part of U.S. public lands policy. Broad-scale intensive forest management may result in increased soil loss, altered wildlife habitat, reduced water quality, and lower soil productivity. The environmental impacts of intensive forestry are not well understood, and further research on its effects may be needed.

Significant changes in Federal programs and policies probably are not required to ensure that future domestic forest products needs are met. However, OTA has identified several policy options which, if implemented, could help to increase the competitiveness of the forest products industry. There are five general types of options:

1. Establish national objectives for management and use of the Nation's forest resources.
2. Encourage research, development, and transfer of forestry-related and wood utilization technologies.
3. Increase international competitiveness of U.S. forest products.
4. Improve the quality of information needed for forest policy formulation.
5. Improve systems for identifying timber management needs.

Possible Congressional Strategies

Two excellent positions—the favorable outlook for domestic timber supplies and the U.S.'s strong potential for increased world trade in wood—together give Congress a range of legislative alternatives for revising forest policies. Congress may choose from among four general strategies:

1. Relinquish responsibility for national timber supplies and industry development to the private sector to meet domestic demands so that little Government involvement and no special incentives are needed. It is assumed that timber supplies are adequate and probably will remain so. This strategy would require modification of portions of RPA that authorize projections of timber supply and demand, reductions in Forest Service program levels, and no special Federal emphasis on increasing forest products exports. Timber management on Federal lands would revert to its status before the

enactment of the NFMA, and the market would determine private investments in timber management and plant expansion.

2. Maintain the status quo, accepting current limitations and uncertainties concerning information in RPA, and make no special effort to induce expansion of the forest products industry beyond present program levels. Under this strategy, ongoing efforts for timber management on Federal and private lands would continue, possibly with incremental changes, but would not be broadened or significantly changed.
3. Continue to rely on the planning process established by RPA as the general guide for Federal policy, but upgrade the information base, forest inventory, and timber inventory to support the development of a wider range of program alternatives and program plans.
4. Identify national goals for developing forest resources to take advantage of future international markets by:
   - improving RPA as indicated in Strategy #3 above,
   - providing aggressive Federal support to the forest products industry in its efforts to expand its role in world markets, and
   - expanding U.S. timber supplies through increased support of research and technical assistance to private forestry and through intensified management of Federal lands.

The degree of congressional action and Federal involvement increases from Strategy #1, which would dismantle the current Forest Service planning system and return to the former decentralized management system, to Strategy #4, which would require more positive Federal support and commitment to expanding U.S. timber potential and increasing international trade in forest products.

The magnitude of the economic and social impacts of a national strategy to strengthen and expand the U.S. role in world trade of forest products is difficult to forecast accurately, but the direction of such changes can be anticipated. Significant expansion of forest production, improved wood utilization, and modernization of old mills and construction of new efficient plants probably would bring increased prices for forest products in the short run. In the long run, however, higher prices could stimulate more investment in efficient manufacturing, forest management, and research than would be undertaken under the existing price structure. As producers shift to more efficient production facilities and more intensive management and harvesting practices, forest product prices could be forced downward. The effects of price increases on consumers is often slight. Wood products in general account for less than 15 percent of the price of the average home, with structural lumber and panels in particular accounting for only 7 percent. The same is true for many other consumer goods—wood is often only a small portion of the price.

The forest products industry currently employs about 1.7 percent of the full-time labor force. Expanding production to meet world demand for forest products could increase employment in the industry. The increase may be modest, however, because modern mills are becoming less labor-intensive as the industry moves toward mechanized technologies. Also, employment in the solid wood (lumber and panel) products sector is subject to wide swings, since production depends on the cyclical homebuilding industry. Increased participation in world markets possibly could cushion this oscillation somewhat, but, as international economies become more closely linked through commerce and banking, so have worldwide economic trends. An expanded U.S. forest products industry role in world trade may not significantly buffer its employees

from the shocks of recurring recession. Increased international trade could result in better price stability for forest products prices, which often dramatically increase as production attempts to meet pent up demand during economic recoveries.

Expanded production could have environmental effects, too. Some observers say that expanded export markets could result in "exporting" the Nation's soil, fisheries, and wildlife as well as forest products if good forest practices are not adhered to. If not conducted properly, timber harvesting and intensive forest management often may change wildlife habitats, affect the availability of forage for livestock, cause erosion, and decrease water quality. Shorter rotations and greater utilization of forest residue may deplete soil nutrients over an extended period of time that could possibly affect future productivity of forest sites. Some timber management practices are incompatible with some forms of outdoor recreation. While severe environmental damage can be avoided in increased management intensity and residue utilization, some negative effects probably are inevitable.

In summary, a program to increase the role of U.S. forest products in international trade may:

- increase the supply of timber available to U.S. producers as well as international markets,
- result in slightly higher employment in the forest products industry,
- increase the U.S. role as an exporter of forest products, thus improving the balance of trade,
- slightly increase the price of housing and other consumer products whose production depends on forest products, and
- cause some deterioration in the environmental quality of U.S. forests.

As a result of the assessment, OTA identified a range of congressional options to deal with all of the major issues (see table 1).

Introduction

The Senate Committee on Appropriations requested that the Office of Technology Assessment (OTA) undertake an assessment of technologies related to the growth and use of U.S. timber resources. OTA found that the technologies were tied closely to the economic conditions affecting the forest products industry and the resource base. With the concurrence of the committee, OTA broadened its assessment to include an evaluation of the role of wood in the U.S. economy. Subsequently, the House Subcommittee on Forests, Family Farms, and Energy wrote to OTA affirming its interest in the assessment.

In response to this congressional interest, OTA undertook a study to answer the following general questions:

- What is the status of technology for increasing the efficiency of wood use in the manufacturing process, for increasing the productivity of U.S. forestlands, and for recovering a larger proportion of timber during harvesting?
- Do Forest Service projections of demand and supply accurately reflect the future potential of technology?
- What is the status of worldwide timber demand and supply, and how will global conditions affect U.S. wood futures?

Table 1.—Summary of Policy Considerations

Option	Action required	Impact of option
Policy Issue A: Establishing objectives for the management and use of the Nation's forest resources		
1. Create a commission to recommend a series of objectives for national timber production for congressional adoption	Establish a committee representing timber, recreation, wildlife, range, water, and consumer interests	Would provide recommendations to Congress as a basis for establishing national timber production goals and objectives and a benchmark for timber management appropriations
2. Formulate congressional objectives for national timber production	Amend the Forest and Rangeland Renewable Resources Planning Act	Would provide targets for USDA's Forest Service to develop programs for timber production, provide guidance for other Federal agencies to achieve national goals, and help the private sector integrate its activities with Government action
3. Direct the administration to formulate specific long-range goals for the Nation's forests, including a comprehensive approach to link the resources of government and the private sector	Administrative action by *all* relevant agencies to implement national goals established by Congress	Would extend Government planninf for timber production and forest products trade to *all* relevant agencies, not just the Forest Service
Policy Issue B: Encouraging research, development, and transfer of forestry-related technologies		
1. Require periodic assessment of the Forest Service R&D Program for congressional review	Amend the Forest and Rangeland Renewable Resources Research Act of 1978	Would enable Congress to evaluate the Federal research budget with respect to national timber production objectives
2. Direct the administration to issue rules, regulations, and guidelines to exempt joint research among private firms from antitrust laws	Issue adminstrative rules, regulations, and guidelines	Would permit private firms to participate in joint research ventures aimed at implementing national timber production and wood products trade objectives
3. Direct USDA to place greater emphasis on forestry technology transfer under the framework provided by the Forest and Rangeland Renewable Resources Research Act, the Renewable Resources Extension Act, and the Cooperative Forestry Assistance Act	Greater funding for Cooperative Extension Service forestry activities, and technology transfer functions of the Forest Service	Would accelerate on-the-ground implementation of recent research findings and technological developments through the education, information, and demonstration services provided by the cooperative extension system, and the Forest Service
4. Establish two or three centers of excellence at universities to focus on improved utilization of wood and wood materials	Legislation creating the regional research centers	Would provide R&D support for improving wood materials
5. Allocate more research funds to the effects of intensified forest management (including harvesting technology) on the environment, soil nutrient levels, wildlife, and other resources	Greater funding of environmental components of the Forest and Rangeland Renewable Resources Research Act related to timber management and harvesting	Would facilitate development of environmentally sound management practices, and provide a better information base about environmental effects of silvicultural activities
Policy Issue C: Enhancing the role of the United States in international trade of wood products		
1. Clearly establish the authority, responsibility and capacity in USDA's Foreign Agricultural Service (FAS) or the Commerce Department's Foreign Commercial Service (FCS) to assist the private sector in developing international markets and removing foreign trade barriers in paper products	Administrative directives or legislative action to assign responsibility and provide for assisting in export of paper products	Would provide assistance to the U.S. pulp and paper industry in expanding exports of paper products (FAS is already responsible for promotion of solid wood products)
2. Direct the U.S. Trade Representative to give priority to identification and negotiation of reductions of tariffs and quotas that restrict U.S. exports of forest products	Congressional directive which may require legislative action or statutory amendments	Would focus the trade representatives' attention on export problems of the U.S. forest products industry

Table 1.—Summary of Policy Considerations (continued)

Option	Action required	Impact of option
3. Direct the administration to improve recordkeeping and statistics on tariffs, quotas, and other barriers affecting international trade in U.S. forest products	Administrative action to upgrade statistical collection and reporting of trade statistics and identification of trade barriers	Would systematically identify and report on existing and developing barriers to U.S. forest products
4. Assign responsibility to a specific agency in the Departments of Agriculture or Commerce to monitor the performance of export trading companies with respect to wood products and recommend needed changes in the legislation or regulations	Congressional directive or legislative amendment, followed by administrative action	Would enable Congress to evaluate the effectiveness of the Export Trading Company Act in strengthening the U.S. position in international trade in wood products
Policy issue D: Improving RPA information for formulating forest policy		
1. Direct the Secretary of Agriculture to give priority to forest inventories in important timber producing States, and to establish priority schedules for inventorying important regions	Congressional directive and administrative action, including budget adjustments	Would provide timely information in States with large and changing inventories, thereby improving the data base for Forest Service projections and timber management programs and budgets
2. Direct the Secretary of Agriculture to improve the coordination of the RPA and RCA planning processes among agencies of USDA	Congressional directive or amendments to the RPA and RCA	Would ensure that uniform treatment and emphasis is given to forestlands by agencies of USDA in planning documents
3. Direct USDA to expand its efforts to monitor fuelwood use and landownership patterns at regional and National levels to improve the reliability of RPA data	Congressional directive and administrative action	Would provide information about the consumption and impact of fuelwood removals and landownership changes on the timber resource and implications of these trends for public policy
4. Direct the Forest Service to provide alternative projections of future timber supply and demand as part of the RPA planning process, and identify the impacts of changes in key variables on demand, supply, and price	Congressional directive and administrative action	Would provide Congress with information that reflects a range of possible futures on which to formulate policies, rather than single-point estimates or "most-likely scenarios" as is now the case
Policy issue E: Identifying timber management needs		
1. Direct the Forest Service to place greater emphasis on hardwood management opportunities	Congressional directive and administrative action to emphasize intermediate stand treatment and hardwood silviculture	Would provide for incremental gains in timber quality and quantity on private lands without major expenditures required for intensive management or species conversion. Would provide information needed to "target" public and private assistance to those lands most suitable for intensive management in cost-effective fashion
2. Direct USDA to undertake a "potential forestland study" to identify extent of marginal, erosive, or reverting agricultural land that may be better suited for timber production than crop or other agricultural uses	Congressional directive and administrative action	Would provide better information for formulation of national policies related to agriculture, conservation and forestry assistance on private lands
Policy issue F: Establishing public and private management priorities		
1. Direct the Department of Treasury, in cooperation with the Forest Service, to report to Congress on effectiveness of current tax treatments in encouraging timber management	Congressional directive to the Secretary of the Treasury, and possible amendments to the Internal Revenue Code	Would establish the extent to which the current tax system supports timber management investments, and would assess impacts, costs, and desirability of alternative systems

Table 1.—Summary of Policy Considerations (continued)

Option	Action required	Impact of option
on private lands, and on alternative strategies (e.g., tax credits to replace capital gains treatment of timber income and tax incentives to industry to expand private forestry incentive programs)		
2. Emphasize Federal assistance programs related to research, education, extension, and technical assistance associated with private nonindustrial forestry	Appropriations to the Forest Service, the Extension Service, the Soil Conservation Service, and other agencies providing forestry related information, education, and technical assistance to private owners	Would place increased emphasis on programs of broad application, leaving the private sector to determine financial investment requirements
3. Focus Federal cost-sharing for tree planting to agricultural land that should be retired from production for a protracted period due to erosion; relinquish most other cost-sharing assistance to the private sector	New legislation or amendments to the Cooperative Forestry Assistance Act, and the Soil Conservation and Domestic Allotment Act of 1936	Would channel limited Federal funds for cost-sharing to areas where timber production would serve multiple public objectives such as erosion prevention and water pollution control
4. If general cost-sharing is maintained, direct the Secretary of Agriculture to focus Government cost-sharing programs on those private lands whose potential for producing timber is greatest	Congressional directive and/or legislative amendments to the Cooperative Forestry Assistance Act and the Soil Conservation and Domestic Allotment Act of 1936	Would ensure that Government investments be made in lands best suited for efficient timber production, and that such investments will contribute to future timber supply
5. Direct the administration to intensify timber management on suitable Federal lands	Increased appropriations and congressional directives	Would accelerate timber growth on suitable Federal lands and increase future yields
6. Investigate alternative timber management and timber sales procedures for Federal lands which would provide industry with incentives to assure increased responsibility for intensive management	Congressional hearings and deliberations, leading to possible legislative enactments and associated administrative action	Would transfer more responsibility for Federal timberland management to the private sector, subject to Federal guidelines, policies, and planning requirements

SOURCE: Office of Technology Assessment.

- Is the manufacturing capacity of the U.S. forest products industry adequate to meet future needs?
- Is U.S. R&D balanced and adequate enough to achieve national goals in the growth, harvesting and utilization of the timber resource?

To answer these questions, OTA first reviewed in detail the existing, emerging, and possible future technologies for converting timber into commercial wood products. Second, technologies for increasing the growth and productivity of the resource and for harvesting timber and transporting it to mills were assessed. Third, based on the potential for technology to increase the capacity to grow timber and manufacture wood products, OTA assessed the status of the U.S. timber resource. Finally, projected domestic and foreign demand for wood products was compared to the ability of various timber-producing nations to meet future global needs.

Federal Forest Management and Policy

The U.S. Department of Agriculture's (USDA) Forest Service has primary responsibility within the Federal Government for administering programs affecting forest resources and wood utilization. The Forest Service manages the National Forest System, which encompasses 190 million acres of forestland located primarily in the West. Approximately half the acreage in national forests is considered to be suitable for commercial timber production. The National Forest System is the Nation's largest single reserve of standing sawtimber and represents about 41 percent of the total U.S. sawtimber resource, consisting mainly of high-value softwood species. Because it is so large, the National Forest System provides nearly one-fourth of the softwood sawtimber consumed annually in the United States. The management of Forest Service lands must accommodate a broad range of uses; therefore timber production may not be maximized in areas where other resource values compete.

Other agencies within USDA also share responsibility with the Forest Service for forestry-related activities. These include the Soil Conservation Service, the Agricultural Stabilization and Conservation Service, the Foreign Agricultural Service, the Cooperative Extension Service, the Science and Education Administration, and the Federal Crop Insurance Corporation. The Bureau of Land Management in the Department of the Interior manages forestlands primarily in Oregon, and the Tennessee Valley Authority undertakes cooperative forestry programs with States and private agencies in the Tennessee Valley region.

Several other Federal agencies also could play prospective roles in facilitating the further development of domestic and international markets for U.S. forest products, including the Departments of Treasury, Commerce, and State, and the Office of the U.S Trade Representative. Most of these agencies have from time to time been involved in forest products-related issues, but not in a focused, coordinated manner.

During the past decade, Congress established a comprehensive assessment and reporting system for forest resources, reaffirming a commitment to resource evaluation articulated in the McSweeney-McNary Act of 1928. The Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (Public Law 93-378), as amended by the National Forest Management Act (NFMA) of 1976 (Public Law 94-585), directs the Forest Service to assess timber supply and resource requirements every 10 years. Based on each assessment, the Forest

Photo credits: U.S. Forest Service

Wildlife and recreation are part of a range of multiple-use management on the National Forest System

Service is directed to formulate 5-year programs that present strategies for achieving national goals. Each assessment and program are used in the Federal budgeting process and serve as guides for the administration of Forest Service programs. However, NFMA's emphasis on the National Forest System limits the usefulness of the RPA assessment and program for guiding national efforts to expand and use timber resources, although there are modest Federal programs to increase forest productivity in the private sector.

Forest Products Industry

The U.S. consumes more forest products, nearly 70 ft³ per capita per year, than any country in the world and accounts for about one-fourth of total world consumption. It is also the leading industrial source of forest products, producing 35 percent of the world's paper, 45 percent of its plywood, and 20 percent of its softwood lumber. The properties of wood make it adaptable to a wide variety of uses, with domestic production linked closely to construction, packaging, and communications requirements:

- About 60 percent of solid wood products (lumber, plywood, and panels) was used in construction in 1976, chiefly in new homes but also for home restoration and remodeling and nonresidential construction. Significant volumes of solid wood products also are used for shipping pallets and containers and in furniture and cabinets.
- The pulp and paper sector produces about equal amounts of paper and paperboard (cardboard, linerboard, and other stiff, thick papers). High-volume paper uses include printing and writing papers (51 percent), newsprint (17 percent), tissues (14.5 percent), and packaging (17.7 percent). Packaging materials (both paper and paperboard) accounted for about 60 percent of domestic paper and paperboard production in 1981.

Fuelwood for residential use recently has reemerged as a major, high-volume timber use. Most residential fuelwood is cut for personal use by homeowners and is not considered an industrial forest product in this report.

Structure of the Industry.—The two major divisions of the forest products industry—the pulp and paper sector and the solid wood (lumber and panel) products sector—display significantly different characteristics and performance:

- The solid wood products sector employs more people. The value added to products in manufacture is greater in the capital-intensive pulp and paper sector.
- Demand for paper products is dependent on general economic conditions, while demand for lumber and panels is dependent on highly cyclical new home construction, which consumes nearly 40 percent of solid wood products.
- The pulp and paper sector is more concentrated than the solid wood products sector, with the 10 largest firms accounting for more than half the pulp, paper, and paperboard products manufactured in North America; the lumber industry (the most competitive subgroup of the solid wood sector) is far less concentrated, with 50 percent of its output produced by 800 firms.

Primary processing of forest products—logging, lumber and panel manufacture, pulping, and papermaking—is concentrated near abundant timber supplies, mostly softwoods in the South and Pacific Northwest. Secondary processing (manufacture into finished products) tends to take place close to markets.

The South is the major pulping region of the United States, accounting for two-thirds of production in 1976. The remaining production was about equally divided between the West (17 percent) and the North (14 percent). Sixty percent of secondary paper manufacture (converted paper products such as containers, bags, sanitary products, and stationery) is located near major markets in New England and the North Central and Middle Atlantic States.

Most lumber and panel manufacture occurs in the West and the South, where softwood timber is most available. The West accounts for more than two-thirds of lumber production, with the South producing most of the remaining one-third. The West also accounts for most panel production, although the South has gained rapidly since the early 1960's. Manufacture of panel products—e.g., waferboard and oriented strand board—is located in the North Central and Northeastern regions, and virtually all expansion is expected to occur in these regions.

Forest Resources

The United States ranks third among nations in exploitable forest area and first in industrial timber production (table 2). U.S. timber grows rapidly, especially in the South where financially mature softwoods can be grown in 30 to 40 years, compared with two to three times longer in many parts of Canada, the Soviet Union, and some parts of the Western United States. Transportation and manufacturing systems are well developed in many heavily forested regions of the country, unlike the U.S.S.R. and most of the developing nations, where roads, railroads, or water transportation systems must be built before interior forests can be harvested.

National timber supplies are likely to be sufficent to meet probable domestic wood demand for the foreseeable future, given current trends in intensive forest management. Beyond this, with increased forest productivity, the United States also can supply a larger share of world wood needs and meet unexpected

Table 2.—Countries With Largest Forested Areas

	Exploitable forest area (million ha)[a b]	Growing stock (million meters³ over bark)[c]		Industrial harvest (billion ft³)
		Total	Coniferous	Broadleaved	1977
U.S.S.R.	389	74,710	62,000	12,710	10.0
Brazil	305	47,088	98	46,990	1.5
United States	195	20,132	12,906	7,226	11.5
Canada	191	19,645	15,571	4,074	5.1

[a]Exploitable forest definitions differ by country. Some countries such as Canada have restrictive definitions that result in conservative estimates of exploitable forestland. Volume estimates for the U.S.S.R. include growing stock on some 110 million acres considered to be unproductive forestland.
[b]To convert hectares to acres, multiply by 2.471.
[c]To convert cubic meters to cubic feet, multiply by 35.31.

SOURCES: United Nations Food and Agricultural Organization, *Yearbook of Forest Products, 1979* (Rome, 1981); G. M. Bonner, *Canada's Forest Inventory 1981* (Environment Canada, 1982); United Nations Environment Program/Food and Agricultural Organization, *Los Recorsos Forestales de la American Tropical* (Rome, 1981); United Nations Economic Commission for Europe, *European Timber Trends and Prosects, 1950 to 2030* (Geneva, 1976); U.S. Department of Agriculture Forest Service, *An Analysis of the Timber Situation in the United States 1952-2030* (Washington, D.C.: U.S. Government Printing Office, 1982).

domestic demand should it arise. There are many opportunities to expand timber supplies significantly through widespread use of existing intensive management technologies for growing, harvesting, and processing timber.

Forestland availability is not likely to become a serious limitation unless wood demand increases dramatically without adoption of technologies capable of increasing timber supplies and improving the efficiency of wood use. **Nevertheless, several trends could affect future timber availability:**

- The U.S. **forestland base probably will shrink** in the future because of conversion for agriculture and development and because of allocation of additional Federal timberland to wilderness and other restricted uses.
- **Private nonindustrial forests (PNIFs) are not owned chiefly to produce timber income.** With the forest products industry owning only 14 percent of the timberlands, it will have to increasingly rely on PNIF lands for future resources. Timber supply in some areas could be reduced by demands for wildlife habitat, recreation, and amenities or for fuelwood.
- **Continued growth in residential fuelwood consumption could be a special concern, because it potentially could compete with the forest products industry for commercial wood supplies. Current fuelwood consumption has been several times higher than anticipated, but available information is not sufficient to determine the extent to which fuelwood may be depleting future timber reserves.**
- State-level survey data on forest acreage and timber inventories is collected infrequently, averaging once every 12 years. As a result, **data at the national level used by the Forest Service in its RPA assessments is based in part on estimated updates and therefore may reduce the accuracy of projected resource trends.**

Technological Opportunities To Extend Timber Resources.—Trends in domestic timber growth are on the whole favorable, although less so for softwood species and the sizes of trees in highest demand. **U.S. timber inventories have been increasing for at least three decades, a reversal of an earlier trend towards decline.** Growing stock on commercial forestland increased from 603 billion ft³ in 1952 to 711 billion ft³ in 1976. Net annual growth in 1976 was 21.6 billion

ft^3 compared to 13.9 billion ft^3 in 1952. **Most of the increase has been in hardwood species,** which could afford major opportunities for expanded wood use for products and fuel. Hardwoods comprise about one-third of the growing stock inventory, but account for only about one-fourth of the national timber harvest.

Two-thirds of the inventory is in softwoods, which are preferred for many high-volume uses. **Softwood stock has increased slowly** due to greater demand and liquidation of old-growth timber in the West. Old-growth stands have enormous volumes of standing timber, but grow very slowly if at all; replacement stands have less volume and smaller trees but grow rapidly.

Existing technologies for growing, harvesting, and processing timber could significantly extend wood resources if widely adopted. Existing processing technologies are able to manufacture high-performance products from wood previously considered too small, unsuitable, or defective. This capability could increase the market for low-demand, less expensive hardwoods and permit the greater utilization of residual or defective materials now left on harvested sites.

Opportunities exist to expand long-term timber supplies through intensive forest management systems (application of planned treatments to forestland to increase growth of industrial-quality timber). Compared to cropland, most U.S. forestland is managed well below the current state of the art of management technology, but this is consistent with forestry's historical role as a residual use of land. Despite the increase in inventories that has occurred in recent years, net growth averages only 60 percent of growth levels that could be achieved if all stands were stocked for optimal growth. Over time, **far greater growth rates could be achieved if harvested stands are replaced with rapidly growing, genetically improved seedlings managed under intensive silvicultural regimes.**

Intensive timber management is expensive, however, with costs of planting alone often exceeding $100 per acre. Economic opportunities for timber management investments may exist on 139 million to 168 million acres in 25 States. The net annual growth increment (net growth attributable to management) could be 11 billion to 13 billion ft^3 annually if all these investments were made—at a cost of approximately $10 billion to $15 billion over the course of a rotation (30 to 50 years).

Land Use and Ownership Trends.—Most forestland in the United States is not owned exclusively for timber production. It often is owned for various other purposes, including recreation, wildlife, or speculation. Of the 482 million acres of "commercial" forestland (forestland considered capable of supplying industrial timber on a sustained basis but not necessarily so used), 58 percent is owned by 7.8 million PNIF owners, most of whom are not chiefly concerned with growing timber. **PNIF owners nevertheless contribute about 47 percent of all timber produced domestically and about 35 percent of the softwood timber. Their share is expected to increase significantly in coming decades.**

Twenty-eight percent of the commercial base is owned by public agencies, usually for multiple uses. The forest products industry owns the remaining 14 percent. **Industry lands contribute disproportionately more to supplies (over 30 percent in 1976) because they tend to be better suited to timber growing than other lands.**

According to the Forest Service, commercial acreage declined 5 percent between 1962 and 1977. **Most of the decline occurred on PNIF land and is attributed largely to diversion of forestland to agriculture and development.**

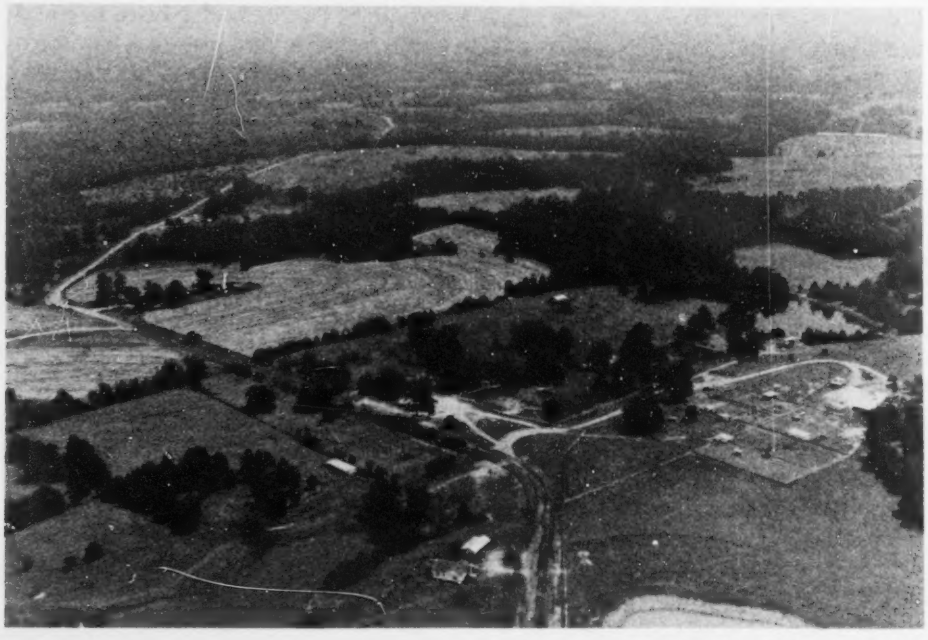

Photo credit: Soil Conservation Service

Much of the forestland in the Eastern United States is privately owned in small lots

Wilderness areas set aside on Federal lands accounted for approximately 30 percent of the decline, but **much of the land reserved as wilderness is not highly productive timberland.**

Public and Private Sector Involvement in Timber Resource Development.—The Federal Government owns about one-fifth of the Nation's commercial timberland and has established several programs to encourage timber management on private lands. Federal lands available for timber production are managed under a multiple-use sustained-yield framework established by statute by Congress. Temporary increases in harvest levels are permitted in some limited circumstances, but changes in existing law probably would be needed to significantly increase harvest levels beyond those included in current Federal planning. Over the long-term, intensive management of Federal lands could increase growth greatly on land available for timber production, but this would require increases in the Forest Service budget to upgrade timber management and to ensure careful attention to impacts on other multiple-use resources.

Forest management activities on private lands are encouraged by a variety of Federal and State programs related to cooperative fire, pest, and insect control programs; research, education, and technical assistance; and financial assistance through tax incentives and direct cost-sharing of management practices with small landowners. Capital gains taxation of timber income is perhaps the greatest single Federal inducement for timber management, although it does not require landowners to use tax savings on management. Several USDA agencies in addition to the Forest Service, including the Soil Conservation Service, the Agricultural Stabilization and Conservation Service, and the Cooperative Extension Service, play roles in providing assistance to forest land owners.

Since the early 1970's, several State governments have expanded their forestry assistance programs. Many States offer preferential tax laws for forest owners, and a few provide limited cost-sharing assistance, either to supplement Federal funds or on an independent basis. Some States are developing State forest plans to establish overall goals for forestry activities and have integrated forest products into their overall industrial development plans. Most States also have forest practices acts, providing guidelines or, in some cases, regulations for harvesting and reforestation.

Because of limited Federal and State budgets, however, private sector interests will be pivotal in determining future levels of management on private nonindustrial lands. Fortunately, a number of forest products firms sponsor landowner assistance programs aimed at the PNIF owner, and efforts of this kind may warrant expansion if government funds are cut back.

Domestic Production and International Trade

The U.S. forest products industry is the most productive in the world. In 1980, the United States ranked first in paper and paperboard, industrial roundwood, nontropical hardwood lumber, plywood, pulpwood, and chip production, and second in softwood lumber production (table 3). Several factors make this leadership possible. Although the United States has only about half of the exploitable forestland that the Soviet Union has, its forests are far more productive due to more favorable climate, terrain, and soils. U.S. forests generally are more accessible than those of most other nations, and the forest products manufacturing capacity of the United States is unsurpassed. The United States also has an enormous demand for forest products, with consumption expected to increase. However, there seems to be no reason that increased domestic consumption would significantly limit U.S. exports of forest products. American forests can support much larger harvests, and technologies capable of increasing timber productivity and manufacturing efficiency are available. Therefore, **the United States is well positioned to satisfy both domestic and a major share of future global forest product requirements.**

Table 3.—Major World Producers of Selected Wood Products

	Industrial roundwood	Sawn softwood	Sawn hardwood	Plywood	Pulpwood and chips[a]	Paper and board
United States	308	58	17	16	109	57
U.S.S.R.	278	87	12	2	38	9
Canada	156	41	—	2	39	13
Sweden	49	—	—	—	26	6
Finland	44	—	—	—	19	6
Japan	—	31	6	8	—	18
People's Republic of China[b]	—	13	8	—	—	5
Brazil	—	—	6	—	—	3
Korea	—	—	—	2	—	2

[a]Pulp production figures are in millions of metric tons. All other products are in million cubic meters.

SOURCES: FAO Yearbook, 1980; National Forest Products Association and the U.S. Foreign Agricultural Service, *Wood for the World, Today and Tomorrow,* n.d.; and M. Bayliss, L. Haas, and S. Reid, "Basically Good Production But a Weak Economy Marked 1980 Record," *Pulp and Paper* (August 1981), p. 67.

By taking advantage of existing opportunities, the United States probably can become a net exporter of forest products before 1990. The United States is currently a net importer of forest products, but during the last 20 years its exports have grown much faster than its imports. This trend probably will persist. It is likely, however, that Canadian wood products will continue to account for large portions of U.S. consumption. Canada's lower production costs, good transportation systems, and nearby softwood forests give Canadian producers an advantage in providing lower grade softwood lumber, woodpulp, and newsprint for Americans. Continued use of these Canadian products increases the opportunities for U.S. producers to export forest products where the U.S. competitive edge is greatest—in paper, panels, hardwood products, and high-quality softwood lumber.

Domestic Demand for Forest Products.—The high productive capacity of the U.S. forest products industry has emerged in response to substantial domestic demands. **The United States is the world's number one consumer of most industrial wood products.** Per capita consumption of lumber, panels, paper, and paperboard in North America is greater than in any other region of the world. The United States consumes almost 25 percent more paper and paperboard per capita than Sweden, which ranks second in per capita use.

U.S. consumption of forest products averaged 12 billion to 13 billion ft^3 per year in the past decade, growing slowly from 8 billion ft^3 at the beginning of the 20th century. About three-quarters of this consumption consisted of softwoods, which are used for most lumber and panels and many types of paper.

Domestic consumption of forest products is expected to nearly double by 2030, according to the Forest Service. While U.S. forests are capable of supporting much larger harvests than they currently do, a 1980 Forest Service analysis projects that this increase in consumption will have significant adverse effects on the economy and the environment as timber becomes more scarce. **OTA found, however, that there is reason to doubt that the Forest Service projections are accurate.** More than likely, Forest Service forecasts of timber demand are overstated. Future domestic demand for wood products probably will grow, but it is unlikely to reach the projected levels unless there is a major upturn in the housing market or government intervention to stimulate wood fuel use. Conversely, the Forest Service forecasts of timber supply are conservative, particularly on forest industry lands, and probably underestimate the ability and willingness of landowners to increase timber production. However, recent data indicate that softwoods on nonindustrial private ownerships are likely to be in shorter supply in the South before 2000 due to a shortfall in softwood reforestation. In addition, the **Forest Service projections probably understate the ability of technology to stretch U.S. wood supplies.** There are many technologies currently available that can improve wood utilization in the forest, in the mill, and in end use.

U.S. Imports of Forest Products.—While the United States is the world's top producer of forest products, it is also one of the largest importers. The majority of U.S. imports are from Canada and consist mainly of lower grade softwood lumber, woodpulp, and newsprint. In 1981, the value of imports from Canada totaled over $7 billion and accounted for over two-thirds of U.S. imports of wood products. The United States also imports substantial amounts of tropical hardwood veneer and plywood from the Far East.

The United States and Canada are mutually dependent for forest products. Canada's share of U.S. lumber markets has grown steadily for over 30 years

and currently accounts for nearly one-third of U.S. lumber consumption. In 1981, the United States consumed approximately two-thirds of Canada's production of softwood lumber, pulp, paper, and paperboard. Although Canada imports smaller quantities of wood products than does the United States (about 1 billion dollars' worth in 1981), the United States is its major foreign source.

U.S. Exports of Forest Products.—Imports of Canadian lumber and newsprint to offset some increases in domestic demand, combined with the productive capacity of the U.S. forest products industry, probably will enable the United States to expand its forest products exports. Although the United States still has a balance-of-payments deficit in wood products trade, the deficit has narrowed in the past decade. In 1982, the United States was a net exporter of solid wood products. Overall, U.S. producers have an unprecedented opportunity to expand their exports for three reasons. First, world demand for forest products, particularly paper, is expected to grow rapidly, possibly increasing by 50 percent by 2000 according to some estimates. Second, at the same time, many countries that have been traditional sources of wood products are unable to expand production significantly because of raw materials limits and lack of installed manufacturing capacity; some regions may even face declining production before the turn of the century. Third, North American producers have both the manufacturing capacity and access to productive forests and skilled labor that could enable them to expand production and capture a growing share of world markets. **U.S. forest products can be manufactured at costs that are competitive throughout the world, an advantage that is probably sustainable for the foreseeable future.**

However, other factors diminish the competitive position of the United States in world markets. The most important of these are global economic and financial conditions. The recent world recession adversely affected U.S. exporters in general, including the forest products industry, which in 1982 experienced a decline in exports from 1981 levels. Spurring the decline was the increased strength of the U.S. dollar relative to other currencies. The U.S. balance-of-payments deficit would have been expected to cause some devaluation of the dollar, but this adjustment has not occurred, primarily because of the enormous Eurodollar market and high U.S. interest rates.

Tariffs, quotas, and nontariff barriers also depress offshore markets for U.S. forest products. **Nontariff barriers probably are the most important.** The most deleterious nontariff barriers affecting U.S. forest products exports currently are product standards, nontariff charges or taxes on imports, preferential trade agreements, and discriminatory ocean freight rates. In the future, preferential trade agreements may have an even greater impact on the ability of U.S. producers to maintain and penetrate world markets. Countertrade, a form of barter between nations, may be particularly troublesome unless the U.S. Government or producers also are willing to engage in countertrade agreements.

Future Potential

The latest assessment required by RPA was prepared by the Forest Service in 1980. Because it projected domestic wood demand to increase more rapidly than timber supply, the 1980 assessment forecasted that timber will become more expensive relative to other products. Although this future is possible, it may not be the most probable. Forest Service demand projections are likely

to be overstated, and timber supply adjustments that would be expected as a result of increasing timber consumption are not given adequate consideration.

In the 1980 assessment, the Forest Service concluded that increased efforts to expand timber production and increase manufacturing efficiency may be needed to meet domestic needs. OTA has concluded that domestic needs probably can be met without major changes in policies affecting timber production. **However, it appears that there may be unprecedented opportunities for U.S. producers to expand forest products exports in the next few decades as well as satisfying domestic needs.**

Opportunities To Expand Exports.—U.S. producers have an opportunity to significantly expand exports of forest products, particularly paper. This opportunity is emerging because world demand for forest products is growing, possibly increasing by 50 percent by 2000. Also, many traditional world timber supply regions are not capable of expanding production to meet this demand—some may even face declining production as a result of deforestation. Furthermore, the United States has a large, modern, efficient manufacturing capacity, forests that can support larger harvests, and access to skilled labor and materials.

Most of the increased consumption of forest products is likely to come from industrialized nations, particularly Western Europe and Japan. Both are already major purchasers of U.S. woodpulp and paper products and probably will buy more in the future. This is because Scandinavia, which supplies large quantities of paper to Western Europe, is facing limits on its forest resource as well as rising pulpwood costs and may be unable to compete with less expensive U.S. paper products, such as linerboard. Also, Japan imports large numbers of logs from Southeast Asia to make paper and other products, but harvest rates in Southeast Asia may not be sustainable through 2000. A cooperative effort between the Foreign Agricultural Service (FAS) and the National Forest Products Association (NFPA) is underway to promote exports of U.S. lumber and panel products to fill these developing needs.

There are several trade barriers that limit the ability of U.S. producers to expand wood products exports. The most important of these are world economic and financial conditions. For several years, global recession has dampened demand for wood while the dollar has remained strong relative to other currencies due to its enormous stocks in Eurodollar markets and high U.S. interest rates. Improvements in these conditions undoubtedly would stimulate U.S. wood exports in spite of other trade barriers.

Trade barriers limit U.S. exports of processed wood products, but not raw materials. The United States probably will have no trouble exporting logs, chips, and pulp in the future, but will need to seek reductions of barriers on processed lumber, panels, and paper products. FAS and NFPA are cooperating in negotiations with foreign producers and governments to reduce tariff and nontariff barriers affecting lumber and panels. Part of this effort is devoted to market promotion, primarily to gain wider acceptance of U.S. homebuilding techniques in order to stimulate demand for American building products.

Lumber and panels are often specialty products, but most U.S. papers are commodities on world markets. Reduction of tariffs on paper products such as linerboard could stimulate U.S. paper exports, particularly in Western Europe, although Scandinavian producers already have free access to these markets due to lower tariffs. While both the Foreign Commercial Service of the Department of Commerce and FAS are authorized to—and do—provide

assistance to the U.S. paper industry in easing trade barriers, specific efforts comparable to the FAS/NFPA initiative in solid wood products do not exist.

Policy Considerations

Federal policies toward forestry and the forest products industry are found in numerous laws that authorize programs and expenditures within the Departments of Agriculture, Interior, Commerce, and Treasury, and within the independent Environmental Protection Agency, Office of the U.S. Trade Representative, and TVA. General statutes, such as the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190), Wilderness Act of 1964 (Public Law 88-577), Clean Air Act (42 U.S.C. 7401 et seq.), the Clean Water Act (33 U.S.C. 1251 et seq.), and others, also affect timber production. State timber policies often are patterned after Federal statutes.

The Federal laws that most directly affect long-term forest management are the Forest and Rangeland Renewable Resources Planning Act (RPA) and its amendment, the National Forest Management Act (NFMA). These statutes are the basis for formulating policies affecting the timber supply, R&D, and the National Forest System.

National Goals.—Although RPA and NFMA direct the Forest Service to prepare a comprehensive assessment every 10 years and a national program every 5 years, the acts provide no clearly stated long-term goals to guide the Forest Service in policy development. In this vacuum, the program and the Forest Service's annual report have become the basis for budget requests and appropriations.

Under NFMA, the Forest Service concentrates heavily on National Forest System policy and programs. In the absence of congressional guidance, however, the Forest Service tends to provide little analysis of policies and programs that it does not specifically administer or that do not pertain to the National Forest System, although there is no limitation on its authority to do so. This emphasis does not address the roles of other Federal and State agencies and the private sector in national timber production.

Thus, while the Forest Service is responsible for overseeing the Nation's wood future, it concentrates primarily on land and forest management. Little attention is given to those economic factors that affect the business practices of the forest products industry.

There have been a number of proposals by private groups that Congress establish a national timber production policy. Proponents of better defined goals note that RPA has enabled the Forest Service to assemble a comprehensive data base on U.S. timber resources and future demand, but RPA does not provide congressional guidance for national strategic planning. RPA's focus on Forest Service programs tends to be of limited use to the private sector and the States, reducing it to little more than a budget justification for Federal activities.

With 10 years of RPA data available, Congress has a great deal of reliable information on which to base decisions on the future role of wood in the U.S. economy. In considering an overall national industrial policy, Congress may wish to foster and promote the forest products industry. Among U.S. basic industries, it is the only one* that has a sustainable resource base; adequate,

*U.S. agriculture shares many of the same advantages, but is not considered an industrial sector.

modern, and efficient plant capacity; expanding international markets; and a competitive edge over most other exporting nations.

U.S. Timber Supply.—National timber famines have been predicted repeatedly since the turn of the century. None has occurred to the extent that the national economy has suffered appreciably. While there have been regional migrations by the forest products industry as certain types of timber have been depleted, major shortages have been avoided through changing technologies, economic adjustments, substitution of other materials, increased production in other regions, and imports. Government programs, such as organized fire protection, also have helped.

The Forest Service's 1980 RPA assessment, like forecasts of the past, anticipates increasing timber scarcity in the future. Major uncertainties are inherent in these projections, however, particularly in their assumptions about future economic conditions, consumer demand (especially housing), timber growth, and technological change.

Because timber demand-supply forecasts continue to be more an art than a science, wide ranges in future timber resource and consumption estimates should be expected. Timber assessment models may be used most effectively in showing how changes in future conditions affect wood demand and supply and in identifying those factors most critical to policy decisions. By generating alternative scenarios based on different economic and resource assumptions, the Forest Service projections could aid Congress in more fully analyzing a variety of options. The majority of the analysis in the 1980 assessment, however, is based only on one scenario.

International Trade.—To benefit from opportunities to export its goods, the forest products industry will have to mount a concerted effort to expand foreign trade. In the past, U.S. firms have concentrated on the vast domestic wood market, with their interest in offshore markets picking up only when U.S. demand slackened. As a result, the U.S. forest products industry has gained international notoriety as a somewhat unreliable supplier. This reputation will have to improve if the U.S. industry is to take full advantage of foreign markets. This change already has started. The solid wood sector of the industry and FAS recently began working on foreign market development and trade barrier reduction.

While the private sector has primary responsibility for export market development, the Federal Government must ensure that as few trade barriers as possible exist between the United States and potential importing nations. Although the U.S. forest products industry is in a strong competitive position internationally, protective tariffs and nontariff trade barriers put U.S. forest products at a disadvantage in a number of major consuming countries. This situation is not unique to forest products, but if U.S. industry is to successfully maintain and penetrate major foreign markets, it will be necessary to overcome these impediments.

Of all forest products, the United States is probably competitively strongest in pulp and paper. Markets for high-strength paper (linerboard) for shipping containers are expected to expand rapidly, and U.S. industry has the current capacity and future potential for supplying them. At the moment, however, FAS is not promoting paper products as actively as it is solid wood products. The Foreign Commercial Service also is authorized to undertake export promotion, but its promotional activities for forest products are minimal.

In 1982, Congress passed the Export Trading Company Act (Public Law 97-290) that authorized the creation of overseas export trading companies with exemptions from certain provisions of the antitrust and banking laws. Currently, the Department of Justice is formulating regulations to govern the operation of these companies. The Japanese have had outstanding success with this concept. Whether U.S. firms can duplicate the Japanese experience will partially depend on how the Justice Department structures its regulations and how skillfully the U.S. industry uses trading companies to expand foreign markets.

Research and Development.—Government, academia, and the private sector share responsibility for conducting forestry research. Traditionally, the Federal Government has played a major part. In general, the Government concentrates on funding basic research and performing R&D functions of a long-term, high-risk nature that are unlikely to be undertaken by the forest products industry in response to market forces. This strong Government involvement is based on the premise that a large portion of the wood-using industry and forest land owners represent small, diverse units with limited capital and knowledge and that the results of such research generally would benefit this group.

Under RPA, the Forest Service has set priorities for research activities. Over 70 percent of the recommended Forest Service R&D budget is devoted to growing, protecting, and inventorying trees. Less than 3 percent is aimed at harvesting technologies, yet, as OTA has concluded in this study, improved harvesting technologies offer important opportunities for stretching the Nation's timber supply.

The forest products industry appears to lag behind other basic industries in research expenditures. It is difficult, however, to obtain reliable data on forest firms' R&D investments because of the proprietary nature of this information. In addition, related industries, such as forestry equipment suppliers, also do some R&D to benefit their customers, but data is unavailable. Antitrust fears undoubtedly have limited joint research programs. There are indications that the Justice Department is becoming more lenient toward cooperative industrial research efforts, but in the absence of clarifying language in the antitrust statutes, the forest products industry is unlikely to move more aggressively.

Private Nonindustrial Timber Management.—Private nonindustrial forests account for 58 percent of the commercial timberland base and supplies about 47 percent of industrial roundwood. These lands, 90 percent of which are located in the East, are accumulating timber inventories—especially hardwoods—at a rapid rate. Timber supplied from PNIF lands is expected to increase significantly, both in volume and as a proportion of total national timber supplies.

At the moment, limited Federal assistance in the form of tax benefits and direct cost-sharing for management expenditures is available to PNIF owners. A key issue in U.S. forest policy is whether the public interest would be served by additional incentives for intensive timber management on private holdings or whether this should be the responsibility of the private sector. The Forest Service and the forest products industry estimate that, over the next few decades, investments of between $6 billion and $9 billion in forest management may be needed on PNIF lands to meet future wood demands. There are cogent arguments both for and against extensive public support of such investments.

Government involvement in private nonindustrial forestry is not limited to financial assistance for management. A variety of research, education, extension, and technical assistance programs have been authorized by Congress in

the past to assist private landowners. While the Forest Service leads in assistance to State and private forestry, on-the-ground delivery of forestry assistance is a cooperative effort between several USDA agencies, State forestry agencies, county agricultural stabilization committees, and soil and water conservation districts.

Since the early 1970's, Congress has enacted several laws to boost private nonindustrial forestry. These include the Forestry Incentives Program (Public Law 93-86), passed in 1974, and the Cooperative Forestry Assistance Act (Public Law 95-313), the Forest and Rangeland Renewable Resources Research Act (Public Law 95-307), and the Renewable Resources Extension Act (Public Law 95-306), all passed in 1978.

Although budgetary constraints have limited the implementation of these laws, the current forestry assistance policy framework focuses more on commodity aspects of private forestland management through:

- Increased emphasis on renewable resource research, technology transfer, and expanded extension services to private nonindustrial forestry. Although funded modestly, these efforts in time could result in more rapid on-the-ground implementation of research findings in much the same way as agricultural research findings have been disseminated effectively to farmers.
- Changes in the tax law that ease inheritance tax burdens on forest land owners and provide favorable treatment of reforestation expenses on a limited basis.
- Potential establishment of crop insurance programs. In 1980, through the Federal Crop Insurance Act (Public Law 96-365), Congress authorized the Federal Crop Insurance Corporation to develop, in cooperation with the Forest Service, an all-risk insurance program for timber crops on a pilot project basis.

A major problem in government landowner assistance is how to target the limited funds available to those lands with the highest potential for cost-effective management. Tracts of less than 100 acres often are too small to capture economies of scale in timber management, yet 47 percent of the acres treated with Federal forestry incentive cost-sharing assistance in 1979 were in tracts of 40 acres or less.

NOTE: Copies of the full report, "Wood Use: U.S. Competitiveness and Technology," can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, GPO stock No. 052-003-00921-8.

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Information on the operation of OTA, the nature and status of ongoing assessments, or a list of available publications may be obtained by writing or calling:

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